

THE FLORA AND PLANT COMMUNITIES OF BODEGA HEAD, CALIFORNIA

M. G. BARBOUR

The distribution, time of flowering, habit (annual-biennial-perennial), and history (native or introduced) of 215 vascular plant species in a 2.5 mi² coastal peninsula are noted. The flora is divided into six communities: dune, grassland, ocean-facing bluff, saline-wet, fresh-wet, and disturbed. Those species which occur in two or more very different communities are discussed. Recent history of Bodega Head is summarized, and aspects of the climate and soil are presented.

INTRODUCTION

Bodega Head, California (38°20'N, 123°04'W) is a coastal peninsula which lies about 65 miles north of San Francisco. The 2.5 mi² area of this study (fig. 1) is limited by State Highway 1 on the northeast, Salmon Creek on the north, Bodega Harbor on the southeast, and Pacific Ocean on the west and south. The Bodega Marine Laboratory and Refuge, owned by the Regents of the University of California, occupies 326 acres near the middle of the peninsula. The facility is used for teaching and research by faculty and students of the Berkeley, Davis, San Francisco, and Santa Cruz campuses.

According to the Geologic Map of California (1963), the southern fourth of the peninsula is of Mesozoic granitic rock (tonalite and diorite), the central half is dune sand, and the northern fourth is of Pleistocene marine and marine terrace deposits. The southern fourth (to which the term "head" is often restricted) is hilly and edged with steep cliffs leading to a rocky shoreline. The highest hill reaches 266 feet. The central dunes are low except for a pronounced foredune (39 feet or less) and hinddune (145 feet or less). Beachgrass (*Ammophila arenaria*) has been planted on the dunes at several times over the past 45 years, and in addition native plants such as *Lupinus arboreus* are common on the hinddune; but sand movement is still considerable and land accretion along the harbor has resulted under prevailing winds from the northwest. The *Ammophila* plants were brought from Golden Gate Park in San Francisco, and originally came from European stock collected by Adolf Sutro. About 45 acres of this central section (along the harbor side) are in a low, fresh-water marsh. The northeastern fourth consists of gentle hills cut by several gulleys running roughly east-west.

Climatic information for the peninsula itself is extremely sketchy but is perhaps sufficient to distinguish it from the climate at the nearest official Weather Bureau station at Fort Ross, 17 miles north. Weather instruments at the Marine Laboratory include a recording anemometer

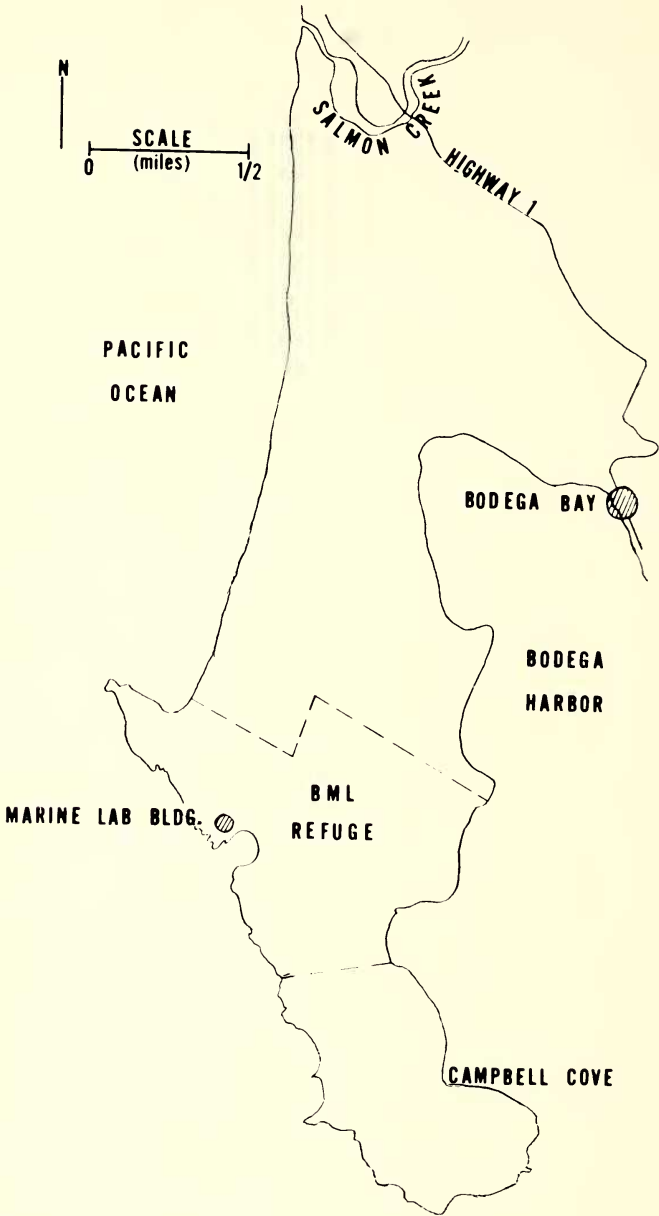


FIG. 1. Map of Bodega Head, boundary of the 326 acre Bodega Marine Laboratory (BML) Refuge is shown by dashed lines.

30 feet above the ground, a thermograph in a standard shelter 4.5 feet above the ground, a pyrliometer, a standard rain gauge, and a max-min thermometer (Taylor type) hung vertically on a shaded stake such that the bottom of the U-tube is 2cm above the ground. These instruments are all located in grassland on the hilly, granitic southern part of the peninsula. The max-min thermometers are read daily. Rainfall records have also been collected since July, 1958 by Otto Henninger in the town of Bodega Bay, less than a mile across the harbor from the center of the peninsula. A summary of the wind records, from December, 1966 to October, 1968 was kindly provided by J. W. Johnson, Professor of Hydraulic Engineering at Berkeley.

As at Fort Ross, the warmest month seems to be August or September. Mean daily maximum (4.5 feet) for August, 1968 was 70°F, mean daily minimum was 60°; mean daily maximum for January, 1968 was 51°, mean daily minimum was 37°. Mean max-mins at Fort Ross (over a period of years) are 68–61° in September and 56–42° in January. Mean max-mins 2 cm above the ground were 73–53 in August, 1968 and 60–43 in January. Annual rainfall is extremely erratic, ranging from 18 inches in July, 1958–June, 1959 to 49 inches in July, 1966–June, 1967. Average rainfall for the 10-year period was 30 inches, and all but 1 inch falls in the period October–April. In contrast, average annual rainfall at Fort Ross is 40 inches. Wind is very predominantly out of the northwest. Of 49 equal-length data collecting periods, the prevailing wind was out of the northwest 63% of the time, out of the southwest 20%, and out of the southeast 17%. Wind speed is approximately equal throughout the year, with average wind speed at 10–12 mph. Storms are most frequent in November, January, and February and during storms billows of foam may be blown across the dunes and grassland. Fog is especially common during late spring and early summer. Insolation ranges from 0.15 kcal/cm²/day in winter to 0.50 kcal/cm²/day in spring.

As an indication of temperatures just above and below the soil in contrast to air temperature, Table 1 lists air, leaf, and soil temperature (taken with thermistor leads and a telethermometer) on the south- and north-facing sides of a small sand hummock in the dune area. The plant was *Ambrosia chamissonis* and its leaves were 1 cm from the sand surface.

Soils are predominantly sandy, ranging from pure sand in the central dunes to sandy loam in the northeast and southern parts of the peninsula. Marked gradients of topsoil salinity exist in the dunes and grassland as one moves inland (east) from the shore. At selected points, about 500 g of soil from the top six inches were collected, dried, put through a 2 mm sieve, and a 1:1 (soil:water) extract made. Conductivity of the extract was measured and converted to ppm total salt (Jackson, 1958). Samples were collected in grassland from the lip of an ocean-facing bluff and at 10-m intervals inland to a distance of 50 m. Table 2 presents the

TABLE 1. AIR AND SOIL TEMPERATURES ON NORTH- AND SOUTH-FACING SLOPES OF A SAND DUNE. OCTOBER 26, 1968, 2 P.M., CLEAR DAY. THE LEAF IS OF AMBROSIA CHAMISSONIS AT $\frac{1}{2}$ INCH ABOVE THE DUNE SURFACE.

Position (inches)	Temperature (°F)	
	South-facing	North-facing
+48	65	65
+ 2	76	67
- $\frac{1}{4}$	107	81
- 3	105	69
- 6	66	66
leaf	72	72

TABLE 2. TOPSOIL SALINITY IN GRASSLAND AS A FUNCTION OF DISTANCE FROM THE LIP.

Distance from lip (meters)	Soluble salts (ppm)
0	1,920
10	960
20	621
30	634
40	454
50	314

results. Samples were collected in dunes from the strand where *Cakile maritima* was growing and at 50-m intervals to a distance of 750 m, where *Lupinus arboreus* was established on the hinddune. Table 3 presents the results.

In addition, the salinity of soil at the base of ocean-facing bluffs (which supported dense stands of *Scirpus koilolepis*, *Distichlis spicata* var. *stolonifera*, and *Jaumia carnososa*) and of sandy flats at the harbor edge (which supported *Salicornia virginica*, *Distichlis spicata* var. *stolonifera* and *Scirpus americanus*) was determined by the same method. Average of two bluff bottom samples was 1,600 ppm; average of five sand flat samples was 4,100 ppm.

The pH of the 1:1 extract was measured with a Beckman portable pH meter. Soil pH did not fluctuate with distance from shore, but did differ between dune (average = 8.3) and grassland (average = 7.2). Bluff bottom and sand flat pH were similar and equal to that of grassland.

RECENT HISTORY

This short summary is taken principally from Kinnard (1966), Hoover and Rensch (1948), Hunt and Sanchez (1929), and personal communications from Cadet Hand.

The Spanish explorer Jaun Francisco de la Bodega y Cuadra discovered Bodega Bay and Bodega Harbor on October 3rd, 1775, but the Russians were the first white men to settle the immediate area. Ivan Kuskov, in 1809, built a settlement at the southeast side of Bodega

TABLE 3. TOPSOIL SALINITY IN DUNES AS A FUNCTION OF DISTANCE FROM THE STRAND.

Distance from strand (meters)	Soluble salts (ppm)	Comments
0	460	strand with <i>Cakile</i>
50	185	foredune
100	122	foredune
150	45	low dunes
200	51	"
250	32	"
300	38	"
350	40	"
400	42	"
450	36	"
500	45	"
550	38	"
600	32	"
650	45	hinddune with <i>Lupinus</i>
700	83	hinddune with <i>Lupinus</i>
750	33	hinddune with <i>Lupinus</i>

Head, near the inlet, at a place now known as Campbell Cove. Kuskov noted it was a wind-blown site and lacked trees, but did have a spring. A larger settlement was built at Fort Ross in 1811. Although the area between Modoga Head and Fort Ross was devoid of timber, the Russians found it adequate for grazing and vegetable growing. Cattle, sheep, horses, and pigs, bought from the Spanish nearby, heavily grazed the area, and potatoes became the favorite crop. By 1830, Fort Ross had become established as a shipyard, and the settlement on the Head became the principal import-export port for food, bricks, and general supplies. A brickyard, built near the Head, exported 10,000 bricks in 1830. The Bay became known to Americans as a good place for ships to take on water.

Within another decade, however, the Russians came to look at their California settlements as a liability because the agriculture was no longer sufficient to sustain the colony without imports, the otter and seal had been hunted nearly to extinction, and it seemed impossible to negotiate with Mexico for more land. The Emperor of Russia gave permission to move to Sitka, and a sale for all movable property was concluded with Captain John A. Sutter. Heavily in debt, Sutter never made payment, and the discouraged Russians left in 1841. Voznesenski's 1841 collection of the flora near Bodega Head has been discussed by Howell (1937).

The Mexican government claimed the land and divided it into large ranchos. Rancho Bodega, some 35,000 acres which ran from the Russian River south to Estero Americano River (present boundary of Marin and Sonoma Counties), was granted to an American named Stephen Smith in 1844. He set up a sawmill in a redwood area to the northeast of Salmon Creek.

TABLE 4. COMPARISON OF COMMUNITY NAMES IN THIS STUDY WITH THOSE DESCRIBED BY MUNZ (1959).

Bodega Head	Munz
dune	coastal strand
grassland	coastal prairie
ocean-facing bluff	coastal strand + northern coastal scrub
saline-wet	coastal salt marsh
fresh-wet	freshwater marsh + northern coastal scrub
disturbed	no equivalent

The goldrush and statehood swelled the population. Rancho Bodega became broken up into several holdings on the peninsula alone, and the Gaffney family came to own over 400 acres in the center. Mrs. Rose Gaffney, who came to Bodega Head in 1913, still lives in Salmon Creek. She recalls that much of the present dune area was pasture in the early 1900's, but that sand continually encroached from the west. Raising potatoes and grazing dairy herds continued to be prime land uses until the 1930's, when many marginal dairy herds were exchanged for sheep. Mrs. Gaffney claims that sheep were grazed on her property for only two months in 1942, but that cattle and horses were regularly present. She remarked that the show of early-summer flowers now (since the property has been a preserve) is much more spectacular than at any previous time.

In 1959, a Chancellor's Committee (Berkeley) For The Selection of a Marine Station Site recommended Bodega Head, and in 1962 the University of California acquired most of the Gaffney property and established it as a reserve. Over 200 acres at the tip of Bodega Head was purchased by Pacific Gas and Electric Company in 1960, with an eye to establishing an atomic-powered steam generator for production of electricity. Proximity of the site of the San Andreas fault, however, led to abandonment of the idea and the land is currently being leased to Sonoma Co. as a recreation area. Most of the dune area was purchased by the State of California in 1962 and incorporated into Sonoma Coast State Beach. The Laboratory was constructed in 1966 with the help of a National Science Foundation grant, and the facility is currently funded by the University of California.

PLANT COMMUNITIES

The flora and community descriptions were compiled in the course of monthly visits to the area over a period of more than 2 years. Undoubtedly there are species and varieties which I have missed, and undoubtedly my choice of communities could be refined with further field work. However, at this point in time, there appear to be six communities on the peninsula: dune, grassland, ocean-facing bluff, saline-wet, fresh-wet, and disturbed. In comparing my species lists for these communities to similar communities described by Munz (1959), it became

TABLE 5. COVER ALONG A 500-M \times $\frac{1}{3}$ -M STRIP TRANSECT OF DUNE (RUNNING FROM STRAND TO HINDDUNE) IN JUNE, 1968.

Species	Cover (%)
bare	49
<i>Ammophila arenaria</i>	30
dead herbage (mostly of <i>Ammophila</i> and <i>Mesembryanthemum</i>)	18
<i>Mesembryanthemum chilense</i>	1
<i>Lupinus arboreus</i>	1
others	1

apparent that the two lists of communities were not quite the same. Table 4 summarizes the relationships between my choice of communities and their closest equivalents in Munz.

Dune. This community covers the largest area (39% of the peninsula). It is characterized by only a few common species, and a change in species with increasing distance from shore. On the strand itself is only one species, *Cakile maritima*, and it occurs in scattered clumps. *Ammophila arenaria*, planted in rows parallel to the shore, dominates the ground from the foredune back. It is especially dense on the foredune. Behind the foredune, *Mesembryanthemum chilense*, *Lotus heermannii*, and *Camissonia cheiranthifolia* are occasional; *Cakile* is absent. Finally, about 700 m from the strand, the hinddune is reached and *Lupinus arboreus* becomes common. On dunes dominated by *Lupinus*, and presumably older, many other species are common: *Abronia latifolia*, *Agoseris apargioides*, *Baccharis pilularis* ssp. *consanguinea*, *Aplopappus ericoides*, *Elymus vancouverensis*, *Ambrosia chamissonis*, and *Poa douglasii*.

In June, 1968, I noted plant cover along a 500-m \times $\frac{1}{3}$ -m strip transect which ran from strand to hinddune. Table 5 summarizes plant cover along the transect.

Grassland. Grassland covers almost as large an area (36% of the peninsula) as dune. In contrast, it is marked by a great diversity of species and a changing seasonal aspect. Very generally, the grassland is dominated by annual and perennial herbs and annual grasses. *Lupinus arboreus* dominates patches of grassland, but is nearly absent over much of it (but small seedlings are occasional to common). Many *Lupinus* shrubs—sometimes singly, sometimes in clusters, sometimes large, sometimes small—exhibit wilted foliage. With time the leaves turn gray and then fall, leaving a skeleton of apparently dead branches. If recently afflicted plants are uprooted, it is seen that the roots are nearly hollowed out by the burrowing activity of a small larva, identified as *Hepialus behrensi* Stretch by W. H. Lange, Professor of Entomology at Davis. An additional pest of *Lupinus*, prevalent in summer, is the caterpillar of the salt marsh moth, *Estigmene acraea*, identified by Paul Hurd, Professor of Entomology at Berkeley.

TABLE 6. COVER ALONG A 200-M \times $\frac{1}{3}$ -M STRIP TRANSECT OF GRASSLAND (RUNNING FROM LIP OF OCEAN-FACING BLUFF INLAND) IN JUNE, 1968.

Species	Cover (%)
dead herbage (mostly of <i>Lupinus</i> and scattered litter)	33
annual grasses (many dying)	32
perennial and annual herbs	30
perennial grasses (mainly <i>Bromus carinatus</i>)	2
bare	2
<i>Lupinus arboreus</i>	1

The spring grassland is a wet green color, dominated by *Montia perfoliata*, *Stachys rigida*, *Luzula subsessilis*, with occasional color from *Arabis blepharophylla*, *Amsinckia menziesii*, *Iris douglasiana*, *Nemophila menziesii*, and *Ranunculus californicus*.

The early summer grassland is a carpet of yellow petals, principally of *Lasthenia chrysostoma*, *Eschscholzia californica*, *Layia platyglossa*, and *Platystemon californicus*. Less abundant herbs includes *Marah fabaceus*, *Phacelia distans*, *Silybum marianum*, *Sisyrinchium bellum*, and *Sonchus* spp. By June and July the grasses dominate the community. The most common species are *Aira caryophylla*, *Bromus arvensis*, *B. diandrus*, and *Lolium multiflorum*, all introduced. The most common native grass, the perennial *Bromus carinatus*, is much less common than the others.

In June, 1968, I noted plant cover along a 200-m \times $\frac{1}{3}$ -m strip transect which ran across typical grassland from the lip of an ocean-facing bluff inland. Table 6 shows annual and perennial cover along the transect.

The late summer grassland is dull brown in color from dead annual grasses. *Eschscholzia californica* and *Lupinus arboreus* continue to flower, and *Achillea borealis* ssp. *arenicola* and *Cirsium vulgare* are common. *Holcus lanatus* forms dense stands in low spots, and its purple-tinged florets add a little more color.

Throughout the year, several species are restricted to the rocky crests of grassland hills: *Arabis blepharophylla*, *Brodiaea pulchella*, *Chlorogalum pomeridianum*, *Iris douglasiana*, *Luzula subsessilis*, and *Rhus diversiloba*.

Ocean-facing bluff. Only 7% of the area is dominated by this community, which occurs at the lip and rocky shelf at the base of ocean-facing bluffs. When the bluff is cut with a gulley so that the face is no longer vertical, the same community occurs down the face. Characteristic species include the low shrubs *Artemisia pycnocephala* and *Eriophyllum staechadifolium*, and the perennial herbs *Armeria maritima* var. *californica*, *Mesembryanthemum chilense*, *Plantago maritima* var. *californica*, and *Spergularia macrotheca*. The annual bulrush, *Scirpus koilolepis*, is

restricted to the basal shelf and often occurs with *Distichlis spicata* and *Jaumia carnosa*. If a seep runs down to the shelf, species of grassland or disturbed communities may be present: *Anagallis arvensis*, *Polypogon monspeliensis*, *Sonchus* spp.

Saline-wet. This community dominates the saline, sandy flats at the edge of Bodega Harbor—about 1% of the area of this study. The species are principally low, rhizomatous perennials: *Distichlis spicata*, *Frankesia grandifolia*, *Jaumia carnosa*, *Salicornia virginica*, *Scirpus americanus*. Further from shore, and less common, are *Atriplex patula* ssp. *hastata* and *Holcus lanatus*.

The water table (brackish water) lies 15 cm or less beneath the surface. Algal mats often coat the ground surface. In October the upper shoots of *Salicornia* turn bright red and make this ordinarily dull-colored, monotonous community more lively.

A prominent species found here but not along saline cliff basis is *Scirpus americanus*, and species common to the cliff bases but not found here are *Mesembryanthemum chilense*, *Scirpus koilolepis*, and *Spergularia macrotheca*.

Fresh-wet. Members of this community range in habitat from fresh-water marshes to soil near seeps to moist, shaded hillsides and gulleys to depressions which exhibit standing water only during the wet season. Fresh-water marshes are dominated by *Scripus microcarpus* and *Sparganium eurycarpum* in the center, *Juncus balticus*, *Juncus leseurii*, *Oenanthe sarmentosa*, and *Potentilla egedii* var. *grandis* near the edge. Surprisingly, *Oenanthe* and *Potentilla* also occur at the edge of some saline flats.

Depressions which are seasonally wet support *Cotula coronopifolia*, *Scripus microcarpus* and *Typha angustifolia*. *Cotula* does also occur in the center of fresh-water marshes, but is not very prevalent there.

Shaded banks, gulleys, and seeps support a great variety of species, principally *Anaphalis margaritacea*, *Calamogrostis nutkaensis*, *Castilleja wrightii*, *Conium maculatum*, *Equisetum telmateia* var. *braunii*, *Heraclium lanatum*, *Mimulus guttatus* ssp. *litoralis*, *Nasturtium officinale*, *Polystichum munitum*, *Rubus procerus*, *Salix laevigata*, *Salix lasiolepis*, *Stellaria media*, and *Vicia gigantea*. There are also a great number of uncommon species, which will not be listed here, except for the rarest: *Fritillaria recurva*, only one specimen seen during the entire two years.

This diverse fresh-wet community occupies about 5% of the study area.

Disturbed. "Disturbed" must be a relative term here, for the entire area has been severely disturbed by grazing, farming, and human activity over the past 150 years. However, plants which are placed in this community occupy sites continuously being traveled over such as roadsides and footpaths. In this light, the disturbed community occupies 12% of the total area.

TABLE 7. SPECIES WITH LONG FLOWERING PERIODS.

Species	Flowering period
<i>Abronia latifolia</i>	April-October
<i>Brassica campestris</i>	March-October
<i>Cakile maritima</i>	March-October
<i>Castilleja wrightii</i>	April-October
<i>Cotula coronopifolia</i>	March-October
<i>Erodium cicutarium</i>	March-October
<i>Eschscholzia californica</i>	March-October
<i>Hypochoeris radicata</i>	April-October
<i>Mimulus guttatus</i> ssp. <i>litoralis</i>	April-October
<i>Nemophila menziesii</i>	March-October
<i>Mesembryanthemum chilense</i>	March-September
<i>Camissonia cheiranthifolia</i>	April-October
<i>Sonchus</i> spp.	April-September

Along grassland paths are *Lasthenia minor*, *Calandrinia ciliata*, *Cardionema ramosissimum*, *Hypochoeris radicata*, *Orthocarpus erianthus* (in patches), *Plantago lanceolata*, *Phacelia distans*, and *Spergularia rubra*.

Roadsides show tremendous fluctuations in seasonal aspect. In spring, *Brassica campestris* and *Raphanus sativus* dominate; in early summer, *Brassica nigra*, *Cotula coronopifolia*, *Lotus corniculatus*, and *Polypogon monspeliensis* dominate; and in late summer and fall *Baccharis pilularis* ssp. *consanguinea*, *Conyza canadensis*, *Epilobium adenocaulon* var. *occidentale*, *Foeniculum vulgare*, *Melilotus albus*, *Rumex crispus*, and *Rubus vitifolius* dominate.

MISCELLANEOUS NOTES

The flora of Bodega Head consists of at least 215 species, representing 157 genera and 56 families. Introduced species make up 36%. Seven introduced species were probably only noted where planted and should not technically be included in the flora: *Acacia longifolia*, *Ceanothus thyrsiflorus* var. *repens*, *Cupressus macrocarpa*, *Eucalyptus globulus*, *Myoporum laetum*, *Pinus muricata* and *P. radiata*.

Some 14 species exhibited very erratic flowering times and were almost equally in flower for a period of 7-8 months. Table 7 lists these species and their flowering period. Only three of these species showed a major peak in flowering within that long period: *Abronia latifolia* (July-August), *Brassica campestris* (March-April), and *Nemophila menziesii* (March-April). *Cakile*, *Cotula*, *Mesembryanthemum*, and *Sonchus* had a few flowers even in December.

Another 11 species were found in two or more quite different habitats; their distributions are summarized in Table 8.

Voucher specimens of all species included in the check list have been deposited in the herbarium of the University of California, Davis (DAV).

TABLE 8. SPECIES WITH UNUSUAL DISTRIBUTIONS.

Species	Distribution
<i>Anagallis arvensis</i>	roadsides, base of ocean bluff in seep
<i>Cotula coronopifolia</i>	roadsides, wet ditches, fresh-water marsh
<i>Dudleya farinosa</i>	lip of ocean-facing bluff and lip of gully
<i>Grindelia stricta</i> ssp. <i>venulosa</i>	roadsides, ocean-facing bluff
<i>Holcus lanatus</i>	edge of saline flat, wet area of grassland
<i>Mesembryanthemum chilense</i>	dunes, lip of ocean-facing bluff
<i>Oenanthe sarmentosa</i>	edge of fresh-water and salt-water marshes
<i>Potentialla egedii</i> var. <i>grandis</i>	edge of fresh-water and salt-water marshes
<i>Polypogon monspeliensis</i>	roadside, base of ocean-facing bluff (in seep), wet, shaded stream bank
<i>Sonchus</i> spp.	grassland, base of ocean-facing bluff in seep
<i>Solanum nodiflorum</i>	stabilized dunes, wet, shaded stream bank

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CHECK LIST

Calamophyta

Equisetaceae

Equisetum arvense L. Common horsetail. Perennial, native. Occasional to common in seasonally wet, but disturbed areas along roads and on steep, wet hillsides. Only vegetative shoots seen.

Equisetum telmateia Ehr. var. *braunii* Milde. Giant horsetail. Perennial, native. Common to abundant on steep, wet hillsides. Fertile shoots produced in March.

Pterophyta

Aspidiaceae

Athyrium felix-femina (L.) Roth var. *sitchense* Rupr. Lady fern. Perennial, native. Rare to occasional in shaded gully near stream.

Polystichum munitum (Kaulf.) Presl. Sword fern. Perennial, native. Common in large clumps on steep, wet hillsides.

Polypodiaceae

Polypodium scouleri Hook. & Gray. Polybody. Perennial, native. Occasional on grassland hill-tops next to rocks.

Pteridiaceae

Pteridium aquilinum (L.) Kuhn var. *lanuginosum* (Bong.) Fern Bracken. Perennial, native. Occasional in grassland, more common when *Lupinus arboreus* is present.

Coniferophyta

Cupressaceae

Cupressus macrocarpa Hartw. ex Gordon. Monterey cypress. Perennial, planted or escaped. Rare along roads, in dunes, near Marine Laboratory.

Pinaceae

Pinus muricata D. Don. Bishop pine. Perennial, probably planted. Rare along road near Salmon Creek.

P. radiata D. Don. Monterey pine. Perennial, probably planted. Occasional along roads.

Anthophyta—DICOTYLEDONEAE

Aizoaceae

Mesembryanthemum chilense Mol. Sea-fig. Perennial, introduced. Common along ocean-facing cliffs (especially at the lip) and on dunes. Flowering sporadic, March-September.

M. edule L. Hottentot-fig. Perennial, introduced. Common in dunes, planted along roadbanks. Flowering March-July.

Anacardiaceae

Rhus diversiloba T. & G. Poison oak. Perennial, native. Occasional in grassland and along shaded streambank. Only vegetative shoots seen.

Apocynaceae

Vinca major L. Periwinkle. Perennial, introduced. Possibly planted in dense strips along one road and at edge of a fresh-water marsh; otherwise rare. Flowering in March and October, possibly in months between.

Berberidaceae

Berberis pinnata Lag. Barberry. Perennial, native. Common on one grassland hill, otherwise rare. Only vegetative shoots seen.

Boraginaceae

Amsinckia menziesii (Lehm.) Nels. & Macbr. Fiddleneck. Annual, native. Common in grassland; variable in size and leaf shape. Flowering April-June.

A. spectabilis F. & M. Fiddleneck. Annual, native. Common on established dunes (with *Lupinus arboreus*); prostrate and sparsely hispid. Flowering June-July.

Cryptantha leiocarpa (F. & M.) Greene. Annual, native. Occasional in dunes. Flowering June.

Plagiobothrys tenellus (Nutt.) Gray. Annual, native. Occasional to common in disturbed areas. Flowering April-May.

Caryophyllaceae

Cardionema ramosissimum (Weinm.) Nels. & Macbr. Perennial, native. Occasional to common as prostrate mats in grassland footpaths. June-July.

Silene gallica L. Windmill pink. Annual, introduced. Occasional in grassland. May-June.

Spergula arvensis L. Spurrey. Annual, introduced. Occasional in disturbed areas. March-July.

Spergularia macrotheca (Hornem.) Heynh. Sand-spurrey. Perennial, native. Occasional to common on shelf at base of ocean-facing cliff, also occasional along path in grassland; prostrate. May-August.

S. rubra (L.) J. & C. Presl. Sand-spurrey. Annual, native. Common in disturbed areas along roads. March-July.

Stellaria media (L.) Cyr. Chickweed. Annual, introduced. Common in grassland, abundant along shaded stream. March-April.

Chenopodiaceae

Atriplex patula L. ssp. *hastata* (L.) Hall & Clem. Annual, introduced. Occasional at outer edge of saline flats near shore. August.

A. patula L. ssp. *obtusa* (Cham.) Hall & Clem. Annual, introduced. Occasional to rare on saline flat near ocean. October.

Chenopodium album L. Pigweed. Perennial, introduced. Rare in seasonally wet area along road. July.

C. ambrosoides L. var. *vagans* (Standl.) Howell. Mexican tea. Annual-perennial, native. Rare in disturbed areas. August-September.

C. californicum (Wats.) Wats. Pigweed. Perennial, native. Occasional in grassland, more common in disturbed areas. April-June.

Salicornia virginica L. Pickleweed. Perennial, native. Abundant in saline flats near shore, common along shelf at base of ocean-facing cliff. October; inflorescences and upper stems becoming reddish at that time.

Compositae

Achillea borealis Bong. ssp. *arenicola* (Hel.) Keck. Yarrow. Perennial, native. Common in grassland, established dunes (with *Lupinus arboreus*), and occasional in disturbed areas along roads. May-October.

Agoseris apargioides (Less.) Greene ssp. *maritima* (Sheld.) Jones. Beach dandelion. Common on established dunes. Flowering sporadic, April-October. Perennial, native.

Anaphalis margaritacea (L.) B. & H. Pearly everlasting. Perennial, native. Common to occasional on steep, shaded, wet hillsides. July-October.

Haplopappus ericoides (Less.) H. & A. Perennial, native. Occasional

on established dunes (with *Lupinus arboreus*). August-October.

Artemisia douglasiana Bess. in Hook. Sagebrush. Perennial, native. Semi-prostrate; occurs in dense clusters on established dunes, in grassland, and along roads; generally rare. August-October.

A. pycnocephala DC. Sagebrush. Perennial, native. Occasional along lip of ocean-facing bluff. July-September.

Aster chilensis Nees. Perennial, native. Occasional in grassland. September.

Baccharis pilularis DC. ssp. *consanguinea* (DC). Wolf. Coyote bush. Perennial, native. Rare in dunes, occasional in disturbed areas along roads. September-October.

Carduus pycnocephalus L. Italian thistle. Annual, introduced. Occasional in disturbed areas. May-June.

Centaurea solstitialis L. Star thistle. Annual, introduced. Rare along roads. September.

Chrysanthemum segetum L. Corn chrysanthemum. Annual, introduced. Rare in disturbed areas along roads. June-July.

Cichorium intybus L. Chicory. Perennial, introduced. Rare in disturbed areas along roads. August.

Cirsium andrewsii (Gray) Jeps. Thistle. Perennial, native. Flowering stalk short (hardly higher than basal leaves); occasional in grassland. May-July.

C. occidentale (Nutt.) Jeps. Thistle. Perennial, native. Tall (to 2 m) and clumped, herbage covered with dense arachnoid pubescence; occasional on established dunes. May-July.

C. vulgare (Savi) Ten. Bull thistle. The most common of the three thistles; common in grassland and in shaded, wet hillside. July-October.

Conyza canadensis (L.) Cronq. Horseweed. Annual, introduced. Common to abundant in disturbed areas along roads. September-October.

Cotula coronopifolia L. Brass buttons. Perennial, introduced. Common in fresh-water marshes and near roads. Flowering sporadic. March-October.

Erechtites arguta (A. Rich.) DC. Fireweed. Annual, introduced. Occasional along roads. July-August.

E. prenanthoides (A. Rich.) DC. Fireweed. Annual, introduced. Occasional at edge of fresh-water marsh, common along steep, wet hillsides, sometimes near roads. July-September.

Erigeron glaucus Ker. Seaside daisy. Perennial, native. Occasional on established dunes and cliff edges, rare in grassland. June-September.

Eriophyllum lanatum (Pursh) Forbes var. *arachnoideum* (Fisch. & Ave-Lall.) Jeps. Perennial, native. Rare to occasional in dunes. May.

E. staechadifolium Lag. Perennial, native. Common along lip of ocean-facing bluff. July-September.

Ambrosia chamissonis (Less.) Greene. Perennial, native. Common on dunes. Two forms occur intermixed: one form with broadly lobed leaves,

the other with smaller, pinnate to bipinnate lobes. The two leaf forms do not occur on the same plant, but the two plants may grow side-by-side. July-August.

Gnaphalium chilense Spreng. Cud-weed. Annual-biennial, native. Occasional in grassland and along roads. May-October.

G. chilense Spreng. var. *confertifolium* Greene. Cud-weed. Annual-biennial, native. Less common than the species; grassland and along roads; June.

G. purpureum Loec. Cud-weed. Annual-biennial, native. Rare along road. May.

Grindelia stricta DC. ssp. *venulosa* (Jeps.) Keck. Gum-weed. Perennial, native. Occasional along road and ocean-facing bluff. May-September.

Hypochoeris radicata L. Hairy cat's ear. Perennial, introduced. The most common member of Compositae; variable in flower size and color (yellow to gold-orange); sometimes with swollen stems. Common in disturbed areas, especially along grassland footpaths. Sporadic flowering, April to October.

Jaumia carnosa (Less.) Gray. Perennial, native. Occasional to common in saline flats near coast and at base of ocean-facing bluff on shelf. September-October.

Lasthenia chrysostoma (F. & M.) Greene. Goldfields. Annual, native. Common to abundant in grassland and in paths through it. May-June.

L. minor (DC.) Ferris. Annual, native. Common in footpaths, less common in grassland. March-April.

Layia platyglossa (F. & M.) Gray. Tidy tips. Occasional to common in grassland and along footpaths through it. May-July.

Madia sativa Mol. Coast tarweed. Annual, native. Common in grassland, occasional in disturbed areas along roads. May-October.

Silybum marianum (L.) Gaertn. Milk-thistle. Annual-biennial, introduced. Occasional in grassland. April-June.

Solidago californica Nutt. California goldenrod. Perennial, native. Rare along shaded stream bank. September.

Sonchus asper L. Sow-thistle. Annual, introduced. Common to abundant in grassland, occasional along roads and on shelf at base of ocean-facing cliff. Flowering sporadic. April-September.

S. oleraceus L. Sow-thistle. Annual, introduced. Distribution and flowering as with *S. asper*.

Wyethia angustifolia (DC.) Nutt. Perennial, native. Rare along roads. April.

Convolvulaceae

Convolvulus occidentalis Gray var. *saxicola* (Eastw.) Howell. Morning glory. Perennial, native. Occasional in grassland. April-May.

Crassulaceae

Dudleya farinosa (Lindl.) Britt. & Rose. Live-forever. Perennial, na-

tive. Occasional on ocean-facing bluff, on rocky hill tops, and at lip of wet, shaded gully. July-August.

Cruciferae

Arabis blepharophylla H. & A. Rock-cress. Perennial, native. Common near summits of grassland hills. March-April.

Barbarea orthoceras Ledeb. Winter-cress. Biennial-perennial, native. Rare in disturbed part of grassland. March-April.

Brassica campestris L. Field mustard. Annual, introduced. Common along roads, occasional in seasonally wet sites. Principal flowering time March-April, a few plants in flower in October, possibly some flowered during intervening months.

B. nigra (L.) Koch. Black mustard. Annual, introduced. Common along roads. Principal flowering time May-August, some through October.

Cakile maritima Scop. Sea rocket. Annual, introduced. Common facing ocean on outer-most dunes or on strand, once seen inland near road in seasonally wet area; occurs in clumps which seem to build mounds of sand. Although *C. edentula* var. *californica* has been reported for the area, I have yet to see it. Flowering sporadic, March-October.

Cardamine oligosperma Nutt. Bitter-cress. Annual-biennial, native. Common in grassland in patches, the siliques popping open and spraying out seeds as one walks through in April. Flowering in March.

Nasturtium officinale R. Br. Water-cress. Perennial, introduced. Common to abundant on very wet shaded streambank and in the stream itself. June-August.

Raphanus sativus L. Wild radish. Annual-biennial, introduced. Common along roads, occasional in grassland; leaves may be smooth or hispid; petals white, yellow, or blue. Principal flowering time March-July, a few in flower in September-October.

Rorippa curvisiliqua (Hook.) Bessey. Yellow-cress. Annual-biennial, native. Rare in disturbed area of grassland. June.

Cucurbitaceae

Marah fabaceus (Naud.) Dunn. Manroot. Perennial, native. Common in grassland dominated by *Lupinus arboreus*. March-June.

Cuscutaceae

Cuscuta salina Engelm. Dodder. Perennial, native. Occasional on *Salicornia* in salt marsh. June.

C. subinclusa Dur. & Hilg. Dodder. Perennial, native. Occasional on *Jaumia* in salt marsh. June.

Frankeniaceae

Frankenia grandifolia C. & S. Perennial, native. Occasional to common at edge of salt flats near ocean. August.

Geraniaceae

Erodium cicutarium (L.) L'Her. Red-stem filaree. Annual, introduced.

Common in disturbed areas of grassland. Flowering sporadic, March-October.

E. moschatum (L.) L'Her. White-stem filaree. Annual, introduced. Also in disturbed areas, but less common than *E. cicutarium*. March-May.

Hydrophyllaceae

Nemophila menziesii H. & A. Baby-blue-eyes. Annual, native. Common in grassland; variable in petal color (white to dark blue). Principal flowering time March, some flowering to August.

Phacelia californica Cham. Perennial, native. Occasional along lip of ocean-facing bluffs. Not seen flowering.

P. distans Benth. Wild heliotrope. Annual, native. Common in disturbed areas of grassland, less common in grassland. April-August.

Labiatae

Mentha pulegium L. Pennyroyal. Perennial, introduced. Occasional on established dunes. September.

Stachys rigida Nutt. ex Benth. ssp. *quercetorum* (Heller) Epl. Hedge-nettle. Perennial, native. Common to abundant in grassland, less noticeable in late summer and fall. Principal flowering in April-May, some flowering to October.

Leguminosae

Acacia longifolia Willd. Perennial, introduced. Probably planted, rare along seasonally wet roadside. April.

Cytisus monspessulanus L. French broom. Perennial, introduced. Rare along roadsides. September.

Lotus corniculatus L. Bird's foot trefoil. Perennial, introduced. Common to abundant along roadsides, creating solid strips of yellow when in flower. June-August.

L. heermanii (Dur. & Hilg.) Greene var. *eriophorus* (Greene) Ottley. Bird's foot trefoil. Perennial, native. Occasional in dunes; petals red to yellow. May-June.

L. subpinnatus Lag. Bird's foot trefoil. Annual, native. The least attractive and least common on the three trefoils; rare along roads. August.

Lupinus arboreus Sims. Lupine. Perennial, native. Common in grassland (abundant in patches), on stabilized dunes at some distance from shore, and occasional on ocean-facing bluffs. April-August; flowers variable in color even on same shrub (white, yellow, blue).

L. bicolor Lindl. ssp. *umbellatus* (Greene) Dunn. Lupine. Annual, native. Occasional along roads. April-July.

Medicago polymorpha L. var. *vulgaris* (Benth.) Shinn. Bur-medick. Annual, introduced. Occasional to common along roads. April.

Melilotus albus Desr. White sweet-clover. Annual-biennial, introduced. Occasional to common along roads. August-September.

M. indicus (L.) All. Yellow sweet-clover. Annual-biennial, introduced. Occasional along roads. April-July.

Trifolium barbigerum Torr. Clover. Annual, native. Occasional in disturbed areas. April.

T. jucatum Lindl. Clover. Annual, native. Rare along lip of ocean-facing bluff. May.

T. repens L. White clover. Perennial, introduced. Occasional to common along roads. June.

T. wormskioldii Lehm. Clover. Perennial, native. Rare to occasional in disturbed areas of grassland. May-July.

Vicia americana Muhl. ssp. *oregana* (Nutt.) Abrams. Vetch. Perennial, native. Occasional to rare in grassland and disturbed areas of grassland. April.

V. californica Greene. Vetch. Perennial, native. Occasional to common in grassland and disturbed areas of grassland. May.

V. gigantea Hook. Vetch. Perennial, native. Common on steep, wet hillsides. March-July.

Malvaceae

Lavatera arborea L. Tree-mallow. Perennial, introduced. Rare along roadsides. July.

Sidalcea malviflora (DC.) Gray ex Benth. ssp. *laciniata* Hitchck. Checker. Perennial, native. Rare along roadsides. April.

Myoporaceae

Myoporum laetum Forst. Perennial, introduced. Planted near Marine Laboratory. Flowering sporadic, March-July.

Myricaceae

Myrica californica C. & S. Wax myrtle. Perennial, native. Rare on steep, wet hillsides. February.

Myrtaceae

Eucalyptus globulus Labil. Tasmanian blue-gum. Perennial, introduced. Planted or possibly escaped in wet, shaded gully. April-August.

Nyctaginaceae

Abronia latifolia Esch. Sand verbena. Perennial, native. Common on established dunes (with *Lupinus arboreus*), occasional along roads in grassland. Flowering sporadic, April-October.

Onagraceae

Epilobium adenocaulon Hausskn. var. *occidentale* Trel. Willow-herb. Perennial, native. Occasional along roads. August-September.

E. watsonii Barbey var. *franciscanum* (Barbey) Jeps. Willow-herb. Perennial, native. Rare along roads. August-September.

Camissonia cheiranthifolia (Hornem. ex Spreng.) Raimann. Evening primrose. Common on established and shifting dunes. Flowering sporadic, April-October.

Oxalidaceae

Oxalis corniculata L. Wood-sorrel. Pearennial, introduced. Occasional in grassland. September.

O. pes-caprae L. Wood-sorrel. Perennial, introduced. Rare in seasonally wet area near road. March.

Papaveraceae

Eschscholzia californica Cham. California poppy. Perennial, native. One of the most comon species in grassland and on established dunes (with *Lupinus arboreus*). Flowering sporadic, March-October.

Platystemon californicus Benth. Cream cups. Annual, native. Common to abundant in grassland; some petals all white, others with yellow tips; variable in size of plant; together with *Lasthenia chrysostoma* and *Eschscholzia californica*, forms much of the spring color show. April-July.

Plantaginaceae

Plantago lanceolata L. Plantain. Perennial, introduced. Occasional to common in disturbed areas. April-July.

P. maritima L. var. *californica* (Fern.) Pilg. Plantain. Perennial, native. Common at base of ocean-facing bluffs. May-July.

Plumbaginaceae

Armeria maritima (Mill.) Willd. var. *californica* (Boiss.) Lawr. Thrift. Perennial, native. Abundant along lip of ocean-facing bluffs, common at their base. April-July.

Polemonicaceae

Gilia capitata Sims. var. *chamissonis* (Greene) Grant. Annual, native. Rare on established dunes (with *Lupinus arboreus*). May.

Navarretia squarrosa (Eschs.) H. & A. Skunkweed. Annual, native. Occasional on established dunes (with *Lupinus arboreus*); giving off a strong skunklike odor easily detected when walking near the plants. June-July.

Polygonaceae

Chorizanthe cuspidata Wats. var. *villosa* (Eastw.) Munz. Annual, native. Occasional along footpath in grassland. June.

Eriogonum latifolium Sm. Wild buckwheat. Perennial, native. Occasional in grassland at some distance from shore, and along lip of ocean-facing bluffs. July-September.

Polygonum patulum Bieb. Knotweed. Annual, introduced. Rare along roads. May.

Pterostegia drymarioides F. & M. Annual, native. Rare in grassland. April.

Rumex acetosella L. Sheep sorrel. Perennial, introduced. Common in grassland and disturbed areas of grassland. March-July.

R. crispus L. Curly dock. Annual, introduced. Occasional along roads. May-July.

R. pulcher L. Fiddle dock. Perennial, introduced. Occasional along roads. June-July.

Portulacaceae

Calandrinia ciliata (R. & P.) DC. var. *menziesii* (Hook.) Macbr. Red maids. Annual, native. Common in disturbed areas; variable in morphology. March-April.

Montia perfoliata (Donn) Howell. Miner's lettuce. Annual, native. Common to abundant in grassland; together with *Stachys rigida* ssp. *quercetorum*, forming much of forb growth in grassland in very early spring. March-April.

Primulaceae

Anagallis arvensis L. Scarlet pimpernel. Annual, introduced. Occasional to common in grassland, in disturbed areas, and rare at base of ocean-facing bluff. Flowering sporadic, March-September.

Ranunculaceae

Ranunculus californicus Benth. var. *cuneatus* Greene. Buttercup. Perennial, native. Common in grassland and in paths of grassland; petals all yellow or white-tipped. March-April.

Rhamnaceae

Ceanothus thyrsiflorus Eschs. var. *repens* McMinn. Blue-blossom. Perennial, native. Probably planted, near Marine Laboratory; only vegetative shoots seen (young plants).

Rhamnus californica Eschs. ssp. *tomentella* (Benth.) Wolf. Buckthorn. Perennial, native. Rare to occasional on steep, wet hillsides. Only vegetative shoots seen.

Rosaceae

Fragaria chiloensis (L.) Duchn. Beach strawberry. Perennial, introduced. Despite the name, only seen in grassland; rare. March.

Horkelia marinensis (Elmer) Crum ex Keck. Perennial, native. Rare about rocks in grassland.

Potentilla egedii Wormsk. var. *grandis* (Rydb.) Howell. Cinquefoil. Perennial, native. Abundant in seasonally wet (fresh water) swale through grassland, also in narrow strip at edge of saline flat near ocean. Flowering April-July principally, a few flowering to September.

Rosa eglanteria L. Eglantine. Perennial, introduced. Occasional in grassland away from coast; viciously armed. Only vegetative shoots seen.

Rubus procerus P. J. Muell. Himalaya berry. Perennial, introduced. Forming tall thickets along shaded stream banks, also as a climber over shrubs in grassland away from the coast. Occasional. June.

R. spectabilis Pursh. var. *franciscanus* (Rydb.) Howell. Salmon berry. Perennial, native. Rare to occasional on steep, wet hillsides. March.

R. ursinus C. & S. California blackberry. Perennial, native. Rare as climber over shrubs away from coast. April.

R. vitifolius C. & S. California blackberry. Occasional in grassland

away from coast and along roads. Perennial, native.

Rubiaceae

Galium asperrimum Gray. Perennial, native, April.

Salicaceae

Salix laevigata Bebb. Willow. Perennial, native. Common in wet, shaded gulleys. Only vegetative shoots seen.

S. lasiolepis Benth. Arroyo willow. Perennial, native. Common in wet, shaded gulleys. Only vegetative shoots seen.

S. lasiolepis Benth. var. *bigelovii* (Torr.) Bebb. Willow. Perennial, native. Rare on established dunes. Only vegetative shoots seen.

Scrophulariaceae

Castilleja wrightii Elmer. Paintbrush. Perennial, native. Occasional to common in seasonally wet (but disturbed) areas, also on steep, wet hillsides; once seen on ocean-facing bluff; bracts and calyx variable in color (yellow, dull red, bright red). Flowering sporadic, April-October.

Cordylanthus maritimus Nutt. ex Benth. Annual, native. Common in the higher part of coastal salt marsh.

Mimulus aurantiacus Curt. Bush monkey-flower. Perennial, native. Common in grassland and along roads away from coast. April-July.

M. guttatus Fisch. ex DC. ssp. *litoralis* Penn. Monkey-flower. Perennial, native. Occasional in seasonally wet areas along roads. Flowering sporadic, April-October.

Orthocarpus erianthus Benth. var. *roseus* Gray. Johnny-tuck. Annual, native. Abundant in rare patches in disturbed parts of grassland. April-May.

Scrophularia californica C. & S. Figwort. Perennial, native. Rare along roads. May.

Veronica americana Schwein. Speedwell. Perennial, native. Occasional near center of fresh-water marsh (with *Sparganium eurycarpum*). July.

Solanaceae

Solanum nodiflorum Jacq. Nightshade. Annual-perennial, native. Occasional herb with flowering shoot over 2 m tall, along roads and in wet, shaded gully. June-July.

Umbelliferae

Angelica hendersonii Coult. and Rose. Perennial, native. Occasional along ocean-facing bluffs. August-September.

Conium maculatum L. Poison hemlock. Occasional along roads and in seasonally wet areas.

Daucus carota L. Queen Anne's lace. Biennial, introduced. Occasional along roads. July-September.

D. pusillus Michx. Ratlesnake weed. Annual native. Rare in dunes. April.

Foeniculum vulgare Mill. Sweet fennel. Biennial-perennial, introduced. Occasional along roads; odor of licorice. July-September.

Heracleum lanatum Michx. Cow parsnip. Perennial, native. Common on steep, wet hillsides. April.

Oenanthe sarmentosa Presl. Perennial, native. Abundant in narrow strip at edge of saline flats near ocean, also in fresh-water marsh. May-September.

Sanicula arctopoides H. & A. Yellow mats. Perennial, native. Occasional in grassland very close to shore. March.

MONOCOTYLEDONEAE

Amaryllidaceae

Allium dichlamydeum Greene. Wild onion. Perennial, native. Rare on grassland hilltops. June.

A. triquetrum L. Wild onion. Perennial, introduced. Rare in seasonally wet area near road. March.

Brodiaea pulchella (Salisb.) Greene. Blue dicks. Perennial, native. Occasional near crests of grassland hills. June-July.

Cyperaceae

Carex barbarae Dewey. Sedge. Perennial, native. Occasional along road. June-July.

Cyperus eragrostis Lam. Umbrella sedge. Perennial, native. Occasional in seasonally wet areas near roads, abundant in center of fresh-water marshes. August-September.

Scirpus americanus Pers. Bulrush. Perennial, native. Common in saline flats near ocean and in standing brackish water. April-June.

S. cernuus Vahl. var. *californicus* (Torr.) Beetle. Bulrush. Annual, native. Rare in dunes. July.

S. koilolepis (Steud.) Gleason. Bulrush. Annual, native. Common in clumps at base of ocean-facing bluffs. August.

S. microcarpus Presl. Bulrush. Perennial, native. Largest of the Cyperaceae: common in fresh-water marshes. July.

Gramineae

Aira caryophylla L. Hairgrass. Annual, introduced. Common to abundant in grassland and in disturbed parts of grassland; contribution to standing biomass often overlooked because of short size. April-June.

Agrostis exarata Trin. Bent grass. Perennial, native. Rare along shaded streambank. July.

Anmophila arenaria (L.) Link. Beachgrass. Perennial, introduced. Widely planted on dunes, probably escaped in other areas; abundant. Flowering sporadic, along the outer dune in July, variable further inland.

Avena barbata Brot. Wild oat. Annual, introduced. Common along roads. May.

Briza maxima L. Quaking grass. Annual, introduced. Rare along roads. June.

B. minor L. Quaking grass. Annual, introduced. Rare along roads. June.

Bromus carinatus H. & M. California brome. Perennial, native. Occasional to common in grassland. May-June.

B. mollis L. Soft chess. Annual, introduced. Rare in disturbed areas. June.

B. diandrus Roth. Ripgut. Annual, introduced. Abundant in grassland, occasional in disturbed areas. April.

Calamagrostis nutkaensis (Presl) Steud. Reedgrass. Perennial, native. Occasional to common on steep, wet hillsides. November.

Cortaderia selloana (Schult.) Arch. & Graebn. Pampas grass. Perennial, introduced. Possibly planted; near Marine Laboratory; rare. September.

Dactylis glomerata L. Orchard grass. Perennial, introduced. Rare along roads. June.

Distichlis spicata (L.) Greene var. *stolonifera* Beetle. Perennial, native. Salt grass. Common in saline flats near ocean and at base of ocean-facing cliffs. Only vegetative shoots seen.

Elymus glaucus Buckl. Rye grass. Perennial, native. Rare in wet, shaded gully. July.

E. vancouverensis Vasey. Rye grass. Perennial, native. Occasional in stabilized dunes (with *Lupinus arboreus*), along roads, and near lip of ocean-facing bluff. August.

Festuca dertonensis (All.) Arch. & Graebn. Fescue. Annual, introduced. Occasional at edge of saline flat near ocean, with *Holcus lanatus*. May.

Holcus lanatus L. Velvet grass. Perennial, introduced. Abundant in low area of grassland (near *Potentilla egedii* var. *grandis*) and on saline flat near ocean; occasional in disturbed areas of grassland. June-August.

Hordeum brachyantherum Nevski. Perennial, native. Occasional in grassland. April.

H. depressum (Scribn. & Sm.) Rydb. Wild barley. Annual, native. Common in grassland, occasional along roads. May.

H. leporinum Link. Farmer's foxtail. Annual, introduced. Occasional in disturbed areas. March-June.

Lolium multiflorum Lam. Italian ryegrass. Annual, introduced. Together with *Aira caryophylla*, *Bromus arvensis*, *Bromus rigidus*, makes up most of the grass cover in grassland. Abundant. May-June.

Poa douglasii Nees. Sand bluegrass. Perennial, native. Occasional on established dunes. March-April.

P. scabrella (Thurb.) Benth. Blue grass. Perennial, native. Occasional in grassland. April.

Polypogon monspeliensis (L.) Desf. Rabbit-foot grass. Annual, introduced. Occasional in disturbed areas and along base of ocean-facing bluff, rare along shaded streambank. June-September. Variable morphology.

Iridaceae

Iris douglasiana Herb. Wild iris. Perennial, native. Occasional in grassland close to and away from the shore. March-April.

Sisyrinchium bellum Wats. Blue-eyed grass. Perennial, native. Occasional in low areas of grassland. April-July.

Juncaceae

Juncus balticus Willd. Rush. Perennial, native. Abundant in occasional patches in wet, low parts of grassland. March.

J. bolanderi Engelm. Rush. Perennial, native. Rare in wet areas along roads. August.

J. bufonius L. Toad rush. Annual, native. Smallest of the rushes at the Head; rare in seasonally wet area near road (with *Cyperus eragrostis*). August.

J. effusus L. var. *brunneus* Engelm. Rush. Perennial, native. Occasional along road. May-October.

J. leseurii Bol. Rush. Perennial, native. The most wide-spread and common of the rushes at the Head; common in dunes near a pond, abundant in fresh-water marsh, occasional along roads. May-October.

Luzula subsessilis (Wats.) Buch. Wood rush. Perennial, native. Common in grassland, especially near crests of hills. March.

Juncaginaceae

Triglochin maritima L. Arrow grass. Perennial, native. Common in salt marsh. May-June.

Liliaceae

Chlorogalum pomeridianum (DC.) Kunth. Soap plant. Perennial, native. Common in grassland; only vegetative shoots seen.

Fritillaria recurva Benth. Fritillary. Perennial, native. Rare, at lip of steep hillside, in grassland. March.

Potamogetonaceae

Potamogeton crispus L. Perennial, introduced. Occasional in fresh water ponds. Leaves broad. Only vegetative material seen.

P. pectinatus L. Perennial, native. Common in fresh water ponds. Leaves linear. Only vegetative material seen.

Sparganiaceae

Sparganium eurycarpum Engelm. Bur-reed. Perennial, native. Occasional in center of fresh-water marshes. July-September.

Typhaceae

Typha angustifolia L. Cat-tail. Perennial, introduced. Occasional in seasonally wet areas near road (often with *Cyperus eragrostis*). August-September.

Zosteraceae

Phyllospadix torreyi Wats. Surf-grass. Occasionally thrown up on beach from near the low-tide level. Perennial, native.

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THE CONSPECIFICITY OF HETEROSIPHONIA ASYMMETRIA
AND H. DENSIUSCULA AND THEIR
LIFE HISTORIES IN CULTURE

JOHN A. WEST

INTRODUCTION

The marine red algal genus *Heterosiphonia* (Ceramiales, Dasyaceae) includes about 40 species which are widely distributed in temperate, tropical and cold waters. The genus is characterized as having polysiphonous and corticated main axes which branch in a sympodial manner. The lateral branches are alternate, distichous and either monosiphonous or polysiphonous. Spermatangia and tetrasporangia are borne in specialized conical reproductive structures called stichidia (Kylin, 1956).

On the Pacific coast of North America five species are known. *Heterosiphonia densiuscula* and *H. laxa* were described from Friday Harbor, Washington by Kylin (1925). Both species are known only from northern Washington and southern British Columbia (Scagel, 1957). *Heterosiphonia asymmetria*, described by Hollenberg (1945), has a range extending from Santa Catalina Island to the Monterey Peninsula in California (Hollenberg and Abbott, 1966). Gardner (1927) described *H. erecta* which ranges from southern California to Baja, California (Dawson, 1963). *Heterosiphonia wurdemannii* Børgesen is broadly distributed in tropical waters and is present in the Gulf of California (Dawson, 1963).

Heterosiphonia erecta and *H. wurdemannii* are described as having four pericentral cells, *H. asymmetria* as having five, and *H. laxa* and *H. densiuscula* as having six to nine. The first two species appear to be morphologically distinct taxa, but *H. asymmetria*, *H. densiuscula* and possibly *H. laxa* appear very closely related, if not identical, for reasons which will be brought out in the observations and discussion section of this paper. Because of the apparent taxonomic problems involving these three species, I considered it necessary to re-investigate various aspects of their morphology and life histories.